

MA Leading by Example Council Meeting

January 23, 2018



State Government LBE Progress – as of Dec. 2017

Greenhouse Gas (GHG)
Emissions



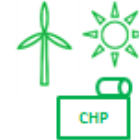
↓ **28%**
2004-2016

Energy Use Intensity per
Square Foot



↓ **12%**
2004-2016

Electricity via Renewable
& Onsite Generation



↑ **20%**
2004-2016

Heating Oil Consumption at
State Facilities



↓ **79%**
2006-2016

22.3 MW Installed Solar PV
at State Sites



↑ **1.2 MW**
in 2017

73 LEED Certified
State Buildings



↑ **14**
in 2017

109 Electric Vehicle Charging
Stations at State Sites



↑ **19**
in 2017

Leading by Example Grants
Awarded



↑ **\$7.7 M**
2015-2017

Agenda



- **Welcome & Introductions**
- **MA Trial Courts Energy and Sustainability Overview**
- **News from Around the World**
- **Commonwealth Updates**
- **Alternative Portfolio Standard**
 - Presentation on recently approved incentives for renewable thermal technologies
 - Discussion
- **LBE Updates**

MA Trial Courts

Energy and Sustainability Overview



Agency Summary

- 62 of buildings, 4.7 million sq. feet
- John Adams Courthouse built in 1894

LEED Certified Buildings

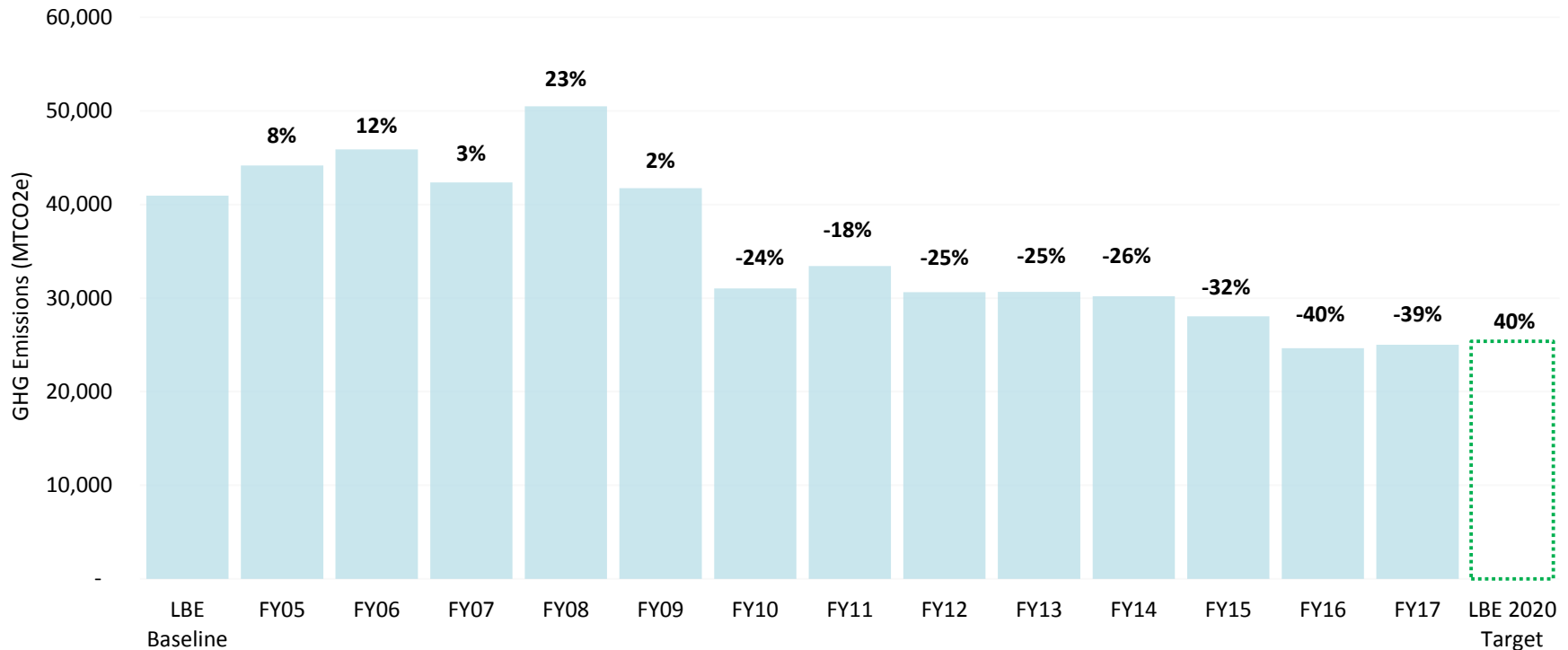


Building	Cert. Level
Fall River District Courts	Gold
Ruane Judicial Center (Essex Co. Juvenile Court)	Gold
Taunton District Court	Gold



LBE GHG Emissions Progress: Trial Courts

Trial Court Annual GHG Emissions w/ % change from LBE baseline



In FY17, GHG emissions have decreased 39 percent from the LBE Baseline, reducing overall annual emissions by 15,944 metric tonnes
(Emissions equivalent to removing 3,357 cars from the road)

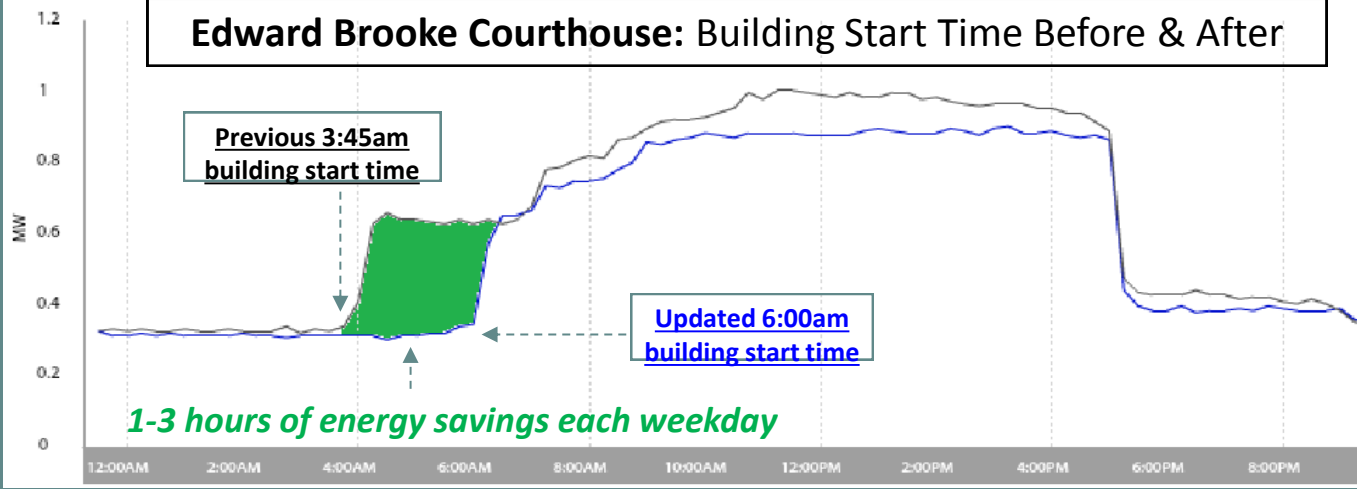
Commonwealth Building Energy Intelligence:

Optimized Building Start-times

- Annual estimated energy savings: ~388,000 kWh
- Annual natural gas savings: ~1,400 therms
- Annual estimated energy cost savings: ~\$66,000
- Implemented from Aug. 2016 – Jan 2017



Edward Brooke Courthouse: Building Start Time Before & After



- **Adjusted schedule gradually in 15 min. increments every few weeks to identify optimal start time**
- **Best practices identified for other TRC facilities**

Billing Info	2016 kWh	2017 kWh	% change
Feb	395,680	341,920	-14%
March	387,560	351,760	-9%
April	392,080	364,000	-7%
May	422,000	370,600	-12%

(Table: MassEnergyInsight data)

Energy Projects

- In FY17, statewide conversion (62 buildings) of T8 fluorescent bulbs to LEDs in FY17
 - Total estimated savings: 2.3million kWh and \$450,000 in energy costs
- Participating in DCAMM's CoFFEE Program:
 - 3 Demand Response Programs implemented in 2017 at Springfield, Salem, and Worcester Courts
 - CoFFEE Funding: \$36,000
 - Est. Annual DR Revenue: \$51,000
- TRC1401E Lawrence & Newburyport Courts Energy Project to be awarded Spring 2018.

Sustainability Initiatives

- Trial Courts Green Team
 - Recycling initiatives (Single Stream)
 - Tracking energy efficiency projects via MEI
 - Outreach to staff to increase awareness about conservation methods both at work and home by host lighting technology workshops at regional courthouses for staff.
- Demand Response: ongoing roll out to new Courts and push to automate selected existing locations.
- Peak shaving efforts are on going; Edward Brooke is no longer the largest electrical consumer. New focus is Worcester Trial Court.
- Working with DCAMM on other potential Enernoc energy initiatives; Facility Optimization & Utility Bill Management.
- Working with DCAMM & DOER in developing a potential rooftop solar PV project at Plymouth Trial Court.

News from Around the World

Fact of the Day

Gasoline vehicles send about **17–21%** of the energy stored in gasoline to turn the wheels

Electric vehicles convert about **59–62%** of their electrical energy to turn the wheels

- Find out on EV emissions (from grid charging) by zip code with EPA [calculator](#), and internal combustion engine vehicle emissions on fueleconomy.gov's [car finder](#)

www.fueleconomy.gov

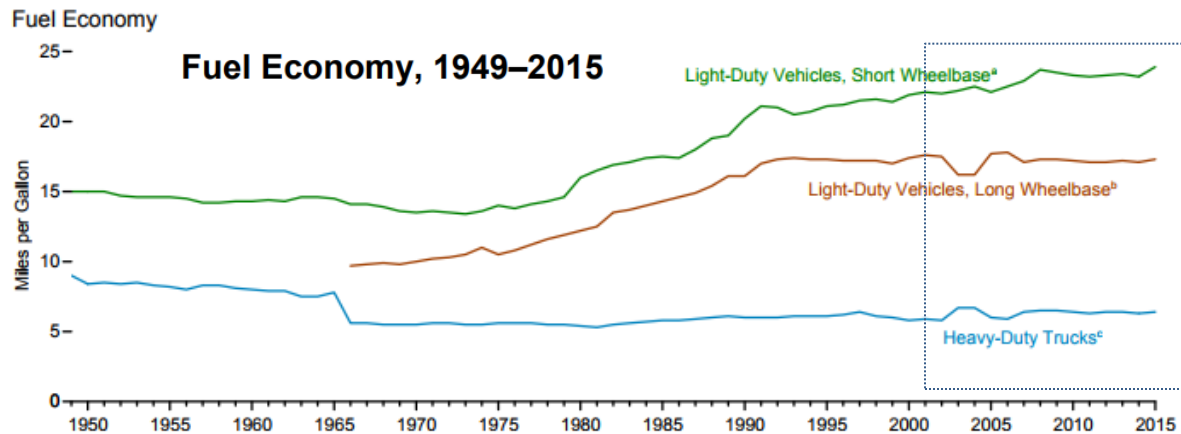
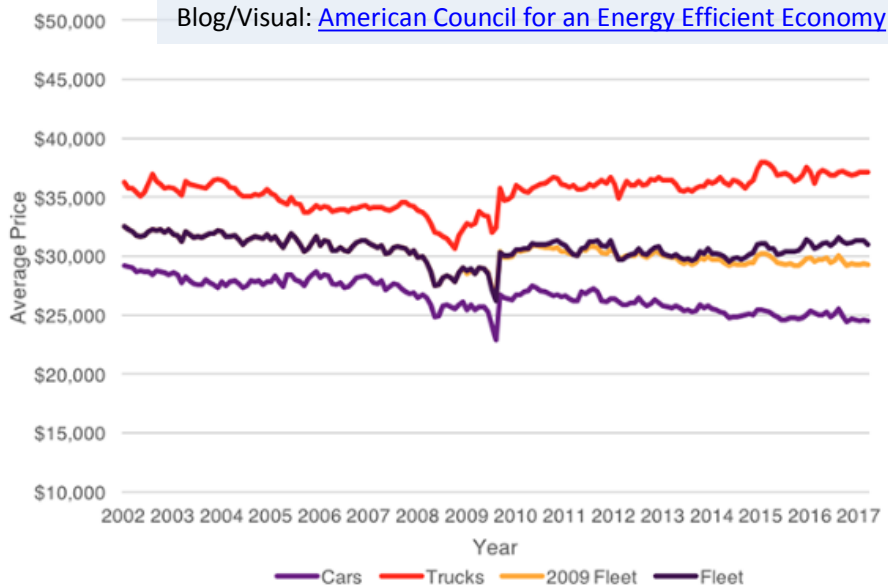
the official U.S. government source for fuel economy information

(LBE's Fuel Efficiency Standard Calculator also an available resource)

[mass.gov/service-details/leading-by-example-tools-guidance-and-tracking](https://www.mass.gov/service-details/leading-by-example-tools-guidance-and-tracking)

Fuel Efficiency

Fuel economy is going up.
Vehicle prices are holding steady.

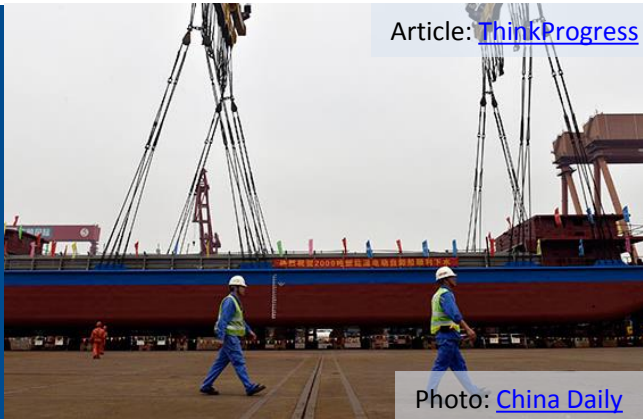


Visual: [US Energy Information Administration \(pg. 18\)](#)

Electric Transportation & Battery Storage

China spoils the launch of world's first electric cargo ship by using it to haul coal

Truly emissions-free shipping will require rapidly shifting off of coal.



Article: [ThinkProgress](#)

Photo: [China Daily](#)

Tesla Semi, an electric big rig truck with 500-mile range, rolls into reality



Article/Photo: [USA Today](#)

Tesla's giant battery farm is now live in South Australia



Article: [Yahoo/Engadget](#)

Photo: [Hornsedale Power Reserve](#)

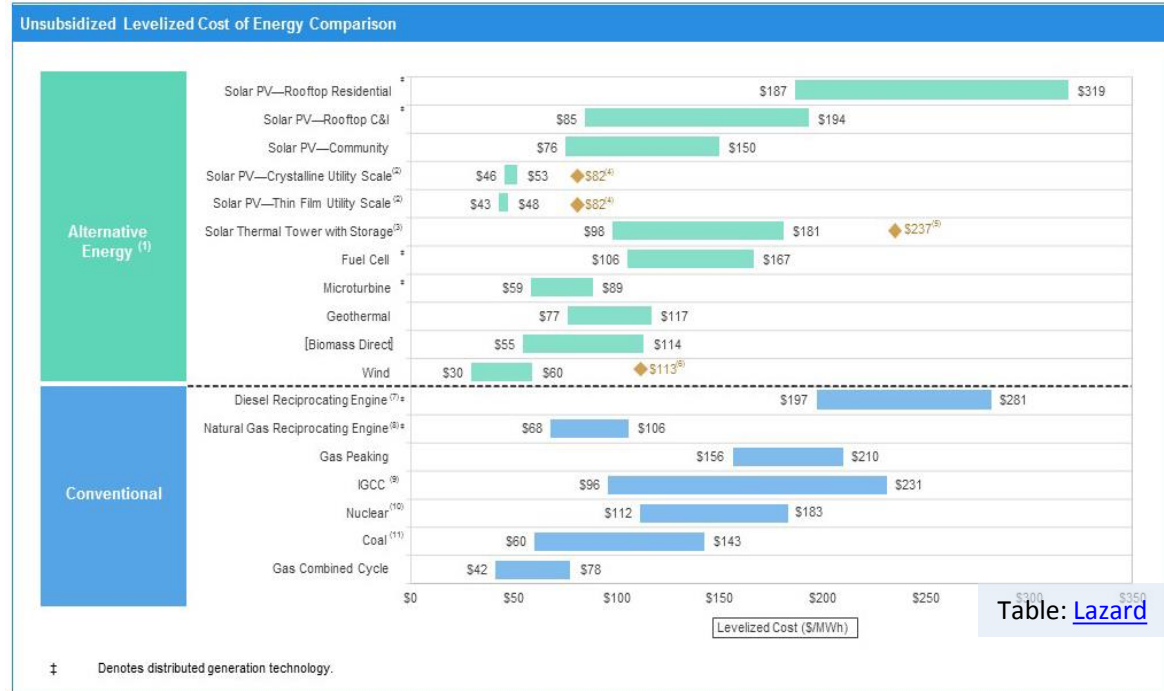
- 100MW storage capacity
- World's largest lithium ion battery
- Power backup for 30,000 homes

Renewables Progress

New study reaches a stunning conclusion about the cost of solar and wind energy

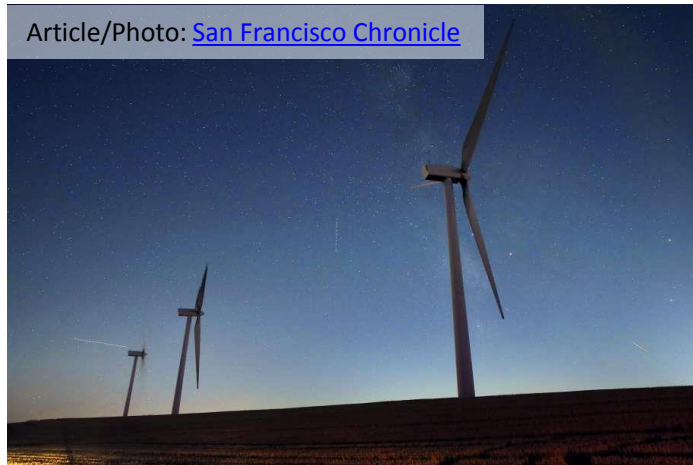
Building new renewables is now cheaper than just running old coal and nuclear plants.

Article: [ThinkProgress](#)



California may reach 50% renewable power goal by 2020 — 10 years early

Article/Photo: [San Francisco Chronicle](#)



Clean Energy and EV Federal Tax Credits

The \$7500 EV Tax Credit Lives On in New Tax Bill

Article/Photo: [Car and Driver](#)



- Phased out by manufacturer when each automaker reaches 200,000 units

Tax Bill Largely Preserves Incentives for Wind and Solar Power



Article/Photo: [New York Times](#)

US Dept. of Energy:

Residential Renewable Energy Tax Credit:

- Solar 30% for qualified expenses, gradual decline in amounts starting 2020

Production Tax Credit

- Wind: kWh based credit for first 10 years of operation
- Construction commenced by 12/31/19

Global Temperatures

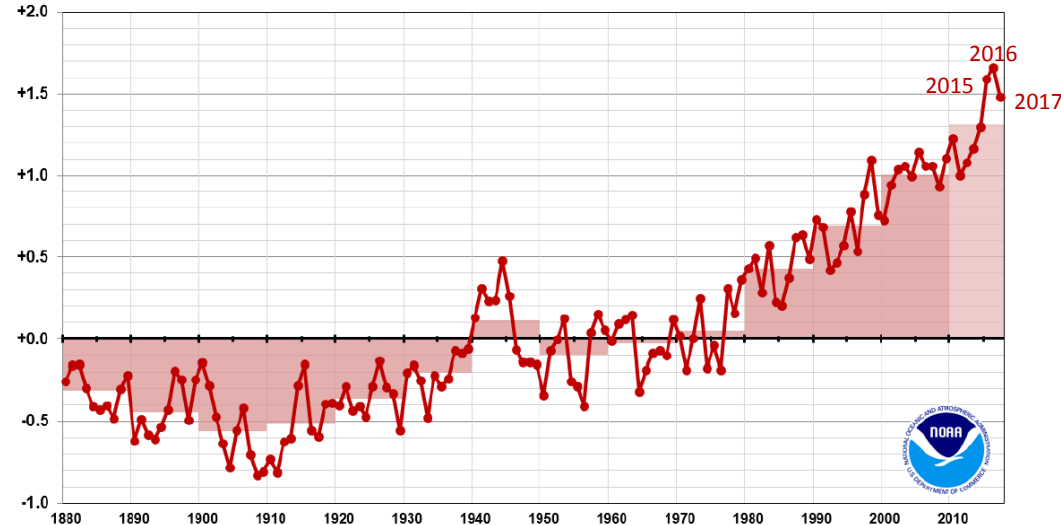
(Separate analyses by NOAA and NASA)

- 2017 in Top 3 of warmest years since 1880
- NASA: When effects of recent El Niño and La Niña patterns statistically removed, **2017 would have been warmest on record**
- NASA: Planet's average surface temperature has risen about 2° (F) in last century or so, driven largely by increased CO₂ and other human-made emissions

- [NOAA-NASA Global Analysis 2017](#)
- [NASA article – Jan. 2018](#)

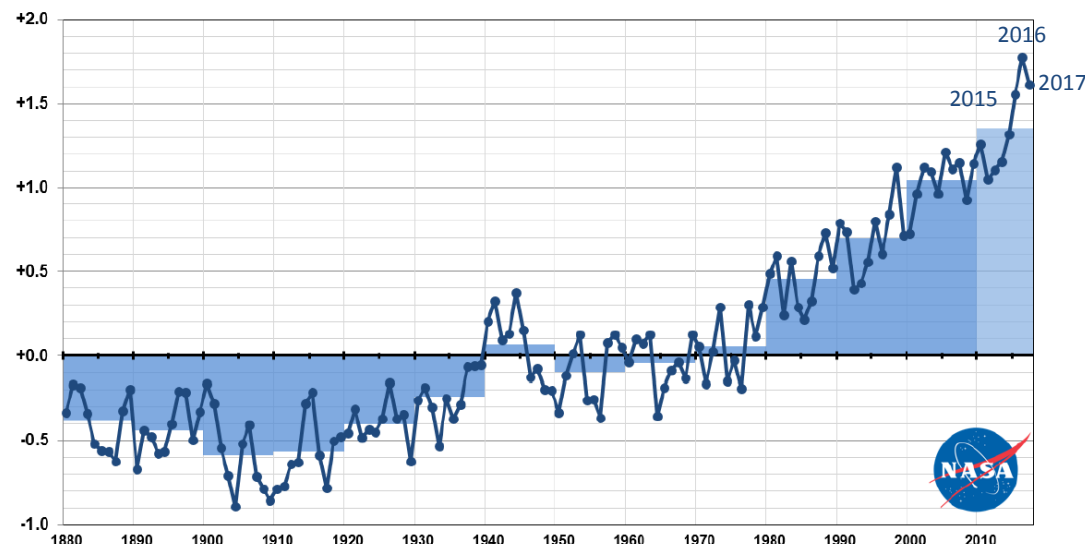
Global Temperature Time Series NOAA GlobalTemp

Annual Global Temperature: Difference From 1951-80 Average, in °F



Global Temperature Time Series NASA GISTEMP

Annual Global Temperature: Difference From 1951-80 Average, in °F



Solar Tariff

- Late yesterday, the Trump Administration imposed a 30% tariff on imported solar cells and modules
- tariffs declining to 25%, 20% and 15% in years 2, 3 and 4
- First 2.5 gigawatts of unassembled solar cells to be imported tariff-free in each year.
- Petitioners Suniva and SolarWorld had asked for a 50% tariff
- Suniva is majority-owned by Hong Kong-listed Shunfeng International Clean Energy Ltd
- 80% of panels are currently imported, mainly from China
- Panels cost around \$1+ per watt



Solar Tariff Reaction

ClearView Energy Partners LLC estimated a roughly 6 percent increase in the costs of commercial solar projects and a 4 percent rise in residential rooftop solar expenses. Large, utility-scale projects may bear the brunt, with a 10 percent increase.

Hugh Bromley, an analyst at Bloomberg New Energy Finance said the decision will “destruct some demand for new projects in the next two years,” Bromley said. “But they will likely prove insufficient in magnitude and duration to attract many new factories.”

The Solar Energy Industries Association warned the tariffs will delay or kill billions of dollars of solar investments and lead to thousands of lost jobs



Massachusetts Department
of Energy Resources

Commonwealth Updates

Energy Storage Project Grants Awarded

- On 12/7, the Commonwealth awarded \$20M in grants for 26 energy storage projects
 - Goal: Develop energy storage market and deliver benefits to ratepayers and grid
 - Projects included:
 - Private and public sectors
 - Battery, flywheel, latent heat storage
 - Demand charges, resiliency, solar plus storage
- LBE provided grant funding to two state projects:
 - UMass Amherst: \$1,143,000 grant
 - 1000kW/400kWh storage system to demonstrate integration of renewable distributed generation
 - UMass Boston: \$850,000 grant
 - 500kW/1820kWh behind-the-meter solar plus storage

[Press Release](#), [Project Descriptions](#)

Potential Funding for EV Charging Stations (1)

- \$1.2 Billion from Electrify America
 - Using VW settlement funds over 10 years for national (not CA) deployment of EV charging infrastructure
 - Examining handful of fast chargers in MA highway corridors and mostly level 2s at around 25 workplace, retail, multi-tenant & community sites
 - Mostly “Boston Metro” area
- VW settlement payments
 - \$71 million to MA for diesel reduction
 - Up to 15% (\$10.65 million) can be used for EV infrastructure
 - Spending priorities being discussed

Potential Funding for EV Charging Stations (2)

- Eversource
 - Received DPU approval to spend \$45 million over 5 years to support EV charging infrastructure
 - 72 fast chargers / 36 sites
 - 3,995 level 2s at 452 sites
 - Funds used for wiring, cabling, trenching, electrical upgrades but not equipment
 - Supporting public access to charging stations (e.g. garages, stadiums, parks, beaches, hospitals, etc.)
 - Looking for large parking lots, ADA compliant, public access, safe and visible
 - Multiple stations
 - Process for applying being developed
- National Grid looking for similar approvals

SMART Program Update

- SMART Competitive Procurement Results
- Bids received and validated
- Base compensation rates set by utility territory
- Solar canopy adder of \$0.06 per kWh
- Public adder of \$0.02 per kWh

	National Grid	Nantucket Electric d/b/a National Grid	NSTAR d/b/a Eversource Energy	WMECO d/b/a Eversource Energy	Fitchburg Gas & Electric d/b/a Unutil
Block 1 Base Compensation Rate (\$/kWh)	\$0.15563	\$0.17000	\$0.17000	\$0.14288	\$0.15563

mass.gov/service-details/smart-competitive-procurement

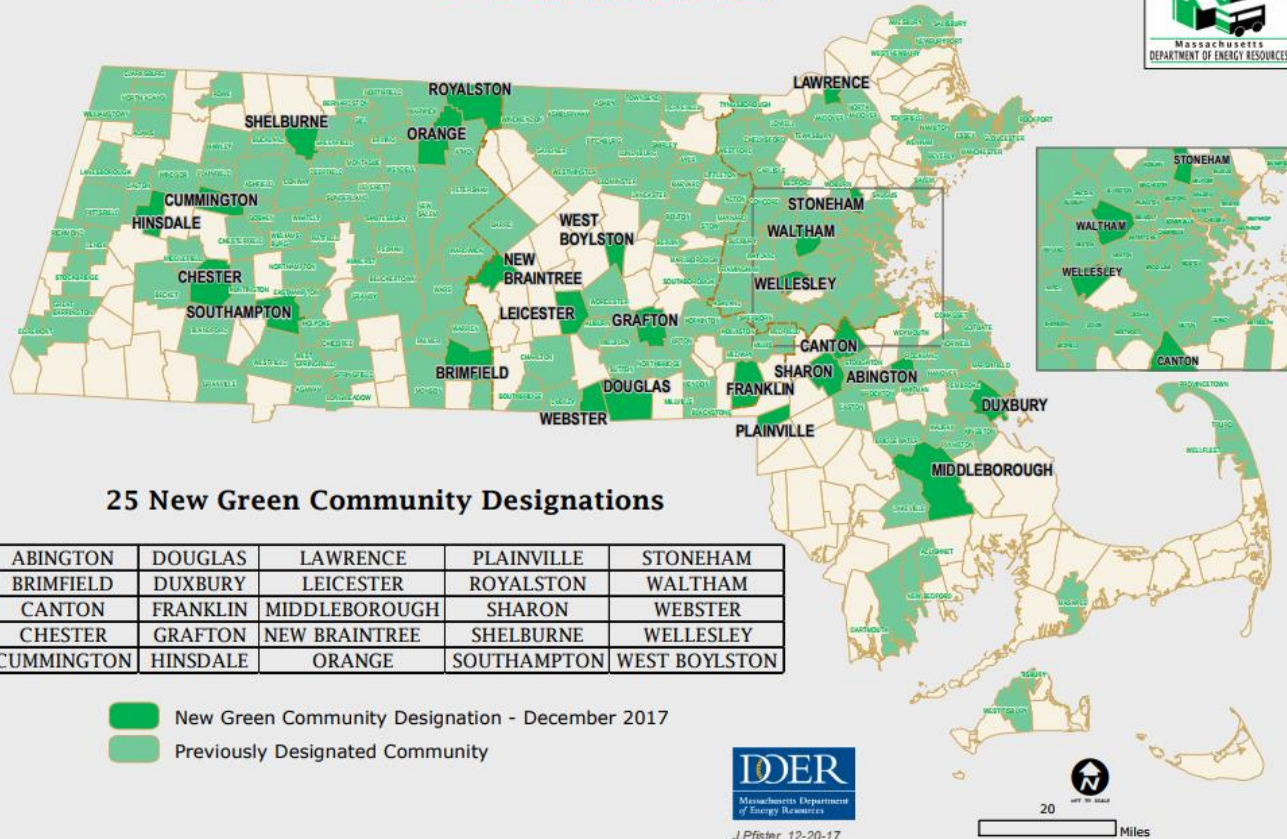
masmartsolar.com

SMART Guidelines Posted

- DOER posted seven Guidelines that clarify rules, procedures, and processes under the SMART Program:
 - *Definition of Agricultural Solar Tariff Generation Units Guideline*
 - *Definition of Brownfield Guideline*
 - *Energy Storage Adder Guideline*
 - *Land Use and Siting Guideline*
 - *Low Income Generation Units Guideline*
 - *Statement of Qualification Reservation Period Guideline*
- DOER seeks written public comments on all of the Guidelines listed above. The draft Guidelines can be found on DOER's [website](#).
- Written comments should be submitted by email to DOER.SMART@state.ma.us and should be sent with the subject line "SMART Guideline Comments." Comments are due by 5 PM on February 23, 2018.

Green Communities Designations

GREEN COMMUNITY DESIGNATIONS REACH TWO HUNDRED TEN



Municipality	Designation Grant
Abington	\$164,900
Brimfield	\$134,500
Canton	\$158,315
Chester	\$130,170
Cummington	\$127,245
Douglas	\$145,940
Duxbury	\$139,705
Franklin	\$183,020
Grafton	\$157,485
Hinsdale	\$130,410
Lawrence	\$594,140
Leicester	\$158,800
Middleborough	\$197,655
New Braintree	\$127,285
Orange	\$159,830
Plainville	\$144,025
Royalston	\$129,365
Sharon	\$148,740
Shelburne	\$132,575
Southampton	\$138,595
Stoneham	\$169,615
Waltham	\$281,080
Webster	\$180,885
Wellesley	\$137,250
West Boylston	\$145,435

- 25 new cities and towns designated in December
- 210 Green Communities in total
 - 68% of MA residents live in a Green Community

Alternative Portfolio Standard

- Presentation on recently approved incentives for renewable thermal technologies
- Q&A

What is the APS?
New Ren. Thermal Technologies
Program Logistics
Air Source Heat Pumps
Ground Source Heat Pumps
Solar Thermal
Biofuels
Biogas/ Compost Heat Exch.
Biomass
Fuel Cells
Waste to Energy
Qualification and Application
Examples
Links and Discussion

What is the APS?

- State program requiring a certain percentage of the in-state electric load served by Load Serving Entities (LSEs) come from renewable energy
- LSEs meet their yearly obligations by procuring Alternative Energy Certificates (AECs)
- One AEC = 1 MWh (or 3,412,000 BTUs)
- Obligation typically expressed as percent of total electric load

Example:

Utility serves 1,000,000 MWh of load in 2017 and has an obligation to procure 4.25% of that through the purchase of AECs

1,000,000 MWh x 0.0425 = 42,500 MWh (number of AECs they must procure)

What is the APS?
New Ren. Thermal Technologies
Program Logistics
Air Source Heat Pumps
Ground Source Heat Pumps
Solar Thermal
Biofuels
Biogas/ Compost Heat Exch.
Biomass
Fuel Cells
Waste to Energy
Qualification and Application
Examples
Links and Discussion

AEC Pricing

- Market driven
- State sets two variables:
 - Minimum Standard
 - Alternative Compliance Payment (ACP) Rate
- Minimum Standard refers to yearly percentage obligations placed upon compliance entities
- ACP rate is the price LSEs must pay for every MWh they are short of meeting their obligation

What is the APS?
New Ren. Thermal Technologies
Program Logistics
Air Source Heat Pumps
Ground Source Heat Pumps
Solar Thermal
Biofuels
Biogas/ Compost Heat Exch.
Biomass
Fuel Cells
Waste to Energy
Qualification and Application
Examples
Links and Discussion

New Technologies in APS

- An Act Relative to Credit for Thermal Energy Generated with Renewable Fuels (S1970) was signed into law in August 2014 and added to the Alternative Energy Portfolio Standard (APS):

“any facility that generates useful thermal energy using sunlight, biomass, bio-gas, liquid bio-fuel or naturally occurring temperature differences in ground, air or water”

- An Act to Promote Energy Diversity was signed into law in August 2016 and added fuel cells and waste-to-energy thermal to the APS

New Eligible Fuel and Technology Types

- Renewable thermal technologies:
 - **Heat pumps (air source and ground source)**
 - **Solar thermal**
 - Liquid biofuels
 - **Biomass**
 - Biogas
 - Compost heat exchange systems
- Non-renewable fuel cells (i.e. natural gas)
- Waste-to-energy thermal

Benefits of Renewable Thermal Technologies

- Currently, 30% of the Massachusetts heating sector is fuel oil alone
- With two natural gas moratoriums across the Commonwealth, renewable thermal technologies provide a cleaner alternative to installing new fuel oil or electric resistance heating systems
- Residential fuel oil is responsible for roughly 9% of the greenhouse gas emissions in Massachusetts, as of 2014
- DOER estimates that the adoption of renewable thermal technologies could result in a 4% reduction in our greenhouse gas emissions, equivalent to 2009 RPS reductions

What is the
APS?

New Ren.
Thermal
Technologies

Program
Logistics

Air Source
Heat Pumps

Ground
Source
Heat Pumps

Solar
Thermal

Biofuels

Biogas/
Compost
Heat Exch.

Biomass

Fuel Cells

Waste to
Energy

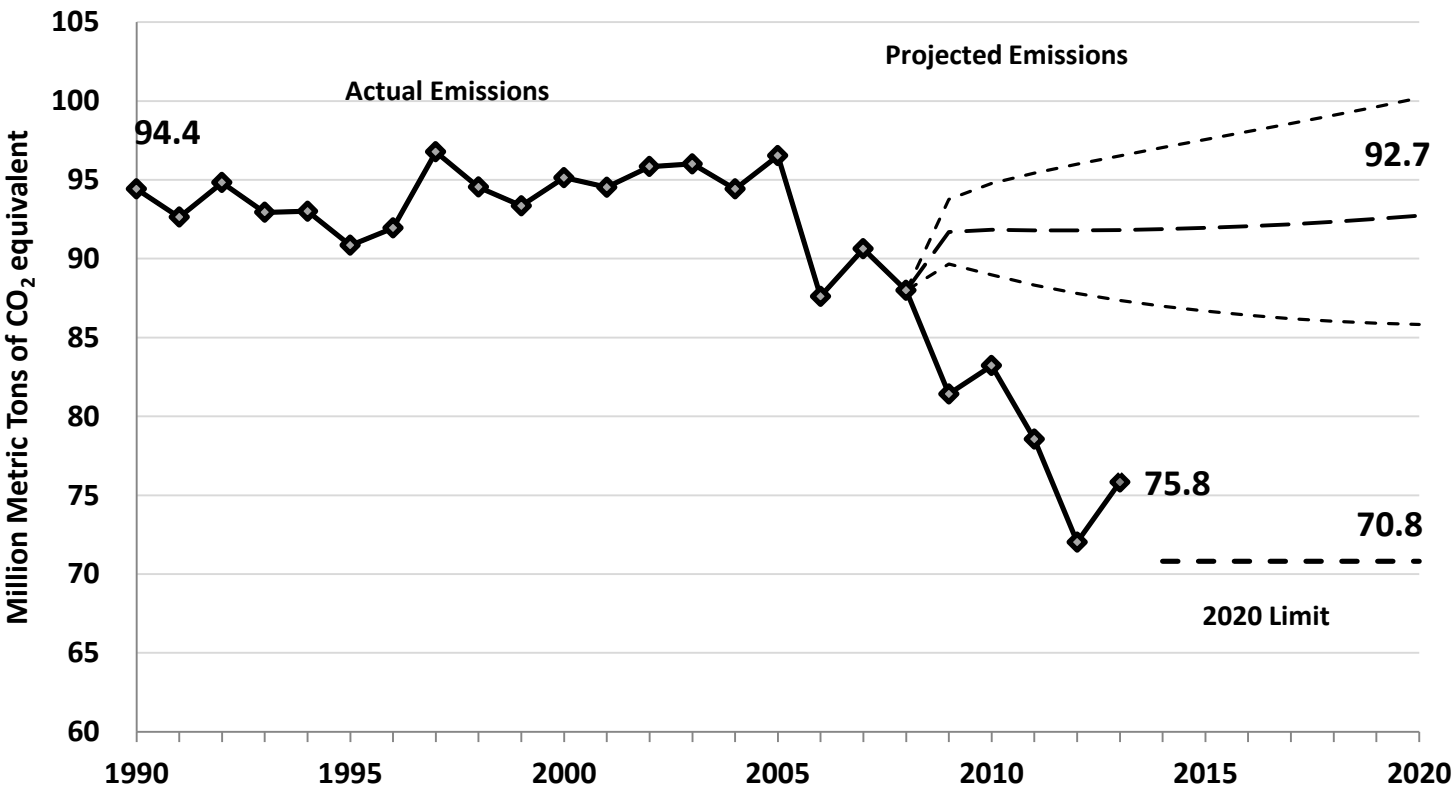
Qualification
and
Application

Examples

Links and
Discussion

Benefits of Renewable Thermal Technologies

Massachusetts GHG Emissions



Creating A Clean, Affordable, and Resilient Energy Future For the Commonwealth

What is the APS?
New Ren. Thermal Technologies
<u>Program Logistics</u>
Air Source Heat Pumps
Ground Source Heat Pumps
Solar Thermal
Biofuels
Biogas/ Compost Heat Exch.
Biomass
Fuel Cells
Waste to Energy
Qualification and Application
Examples
Links and Discussion

Program Logistics

- **System must have come online after January 1st 2015**
- Systems operating since January 1st 2015 are eligible to receive retroactive credits, but must apply and be qualified before the minting on April 15th
- Incentive is only for the Useful Thermal Energy used for heating, not cooling
- Small systems will receive 10 years of AECs in 1st quarter of qualification
- Intermediate and Large systems will receive AECs quarterly with no end date on their qualification
- Non-emitting technologies will receive a multiplier, generating more than 1 certificate per MWh

Small, Intermediate, and Large Generators

- All renewable thermal generators are divided into three size categories as follows:

	Size Classification			
	Small	Intermediate		Large
AEC calculation basis	Calculated net renewable thermal output	Calculated net renewable thermal based on <u>indirect</u> metering	Calculated net renewable thermal output based on <u>direct</u> metering of fuel input	Metered net renewable thermal output
Solar thermal: evacuated tube and flat plate solar hot water	Collector surface area less than or equal to 660 sq ft	Collector surface area between 660 and 4,000 sq ft	-	Collector surface area greater than or equal to 4,000 sq ft
Solar thermal: solar hot air	-	Collector surface area less than or equal to 10,000 sq ft	-	Collector surface area greater than 10,000 sq ft
Solar sludge dryer	-	-	-	All
Eligible Biomass Fuel	-	-	Capacity less than or equal to 1,000,000 Btu per hour	Capacity greater than 1,000,000 Btu per hour
Compost heat exchange system	-	-	-	All
Air source heat pump: electric motor or engine driven	Output capacity less than or equal to 134,000 Btu per hour	-	Output capacity between 134,000 and 1,000,000 Btu per hour	Output capacity greater than or equal to 1,000,000 Btu per hour
Ground source heat pump	Output capacity less than or equal to 134,000 Btu per hour	-	Output capacity between 134,000 and 1,000,000 Btu per hour	Output capacity greater than or equal to 1,000,000 Btu per hour
Deep geothermal	-	-	-	All

- Classification determines how generators meter and report their thermal output
- Not all technologies have all three classifications

Creating A Clean, Affordable, and Resilient Energy Future For the Commonwealth



Massachusetts Department
of Energy Resources

What is the APS?
New Ren. Thermal Technologies
<u>Program Logistics</u>
Air Source Heat Pumps
Ground Source Heat Pumps
Solar Thermal
Biofuels
Biogas/ Compost Heat Exch.
Biomass
Fuel Cells
Waste to Energy
Qualification and Application
Examples
Links and Discussion

Pre-Minting and Forward Minting

Small heat pumps and solar thermal systems may choose to pre-mint their AECs

- **Pre-minting** of AECs allows certain generators to receive 10 years of AECs upfront in the first quarter of operation

However, if the APS market switches from being more than 25% undersupplied, to less than 25% undersupplied, pre-minting is replaced by Forward minting

- **Forward minting** of AECs allows generators to receive a pre-determined number of AECs each quarter over a period of 10 years

Biomass, biogas, and liquid biofuel generators may not pre-mint or forward mint their AECs

What is the
APS?

New Ren.
Thermal
Technologies

Program
Logistics

Air Source
Heat Pumps

Ground
Source
Heat Pumps

Solar
Thermal

Biofuels

Biogas/
Compost
Heat Exch.

Biomass

Fuel Cells

Waste to
Energy

Qualification
and
Application

Examples

Links and
Discussion

Certificate Multipliers

- The statute allows for DOER to establish credit multipliers for “non-emitting renewable thermal technologies”
- DOER has established the following multipliers for non-emitting renewable thermal technologies:

	APS Renewable Thermal Generation Unit multiplier		
System size	Small	Intermediate	Large
Active solar hot water systems used for domestic hot water	3	3	3
Active solar hot water systems used for domestic hot water, space condition, or process loads	1	1	1
Active solar hot air systems	-	5	5
Solar sludge dryer	-	-	1
Ground source heat pumps	5	5	5
Deep geothermal	-	-	1
Air source heat pumps (electric or engine driven) – supplying less than 100% of building heating load ²	2	-	-
Air source heat pump (electric or engine driven) – all other ²	3	3	3
Compost heat exchange system	-	-	1
Biomass, biofuels, biogas	N/A	N/A	N/A

More information on these multipliers can be found in the Guideline on [Multipliers for Renewable Thermal Generation Units](#).

Creating A Clean, Affordable, and Resilient Energy Future For the Commonwealth

DOER

Massachusetts Department
of Energy Resources

What is the APS?
New Ren. Thermal Technologies
<u>Program Logistics</u>
Air Source Heat Pumps
Ground Source Heat Pumps
Solar Thermal
Biofuels
Biogas/ Compost Heat Exch.
Biomass
Fuel Cells
Waste to Energy
Qualification and Application
Examples
Links and Discussion

Additional Multiplier for Heat Pumps

- Any air or ground source heat pump installed in a building shall be eligible for an additional multiplier of 2 (added to the base multiplier) if the building meets any of the following criteria:
 - achieves Home Energy Rating System (HERS) rating of 50 or less
 - meets the Department of Energy definition of “Zero Energy”
 - achieves PHIUS+ Certification by the Passive House Institute US (PHIUS)
 - registers as a Certified Passive House Building or an EnerPHit Retrofit by the International Passive House Association (iPHA)

What is the APS?
New Ren. Thermal Technologies
Program Logistics
<u>Air Source Heat Pumps</u>
Ground Source Heat Pumps
Solar Thermal
Biofuels
Biogas/ Compost Heat Exch.
Biomass
Fuel Cells
Waste to Energy
Qualification and Application
Examples
Links and Discussion

Air Source Heat Pumps

- Can only receive Alternative Energy Certificates (AECs) when operating in heating mode
- Small air source heat pumps must:
 - be ENERGY STAR™ certified
 - meet the Cold Climate Air Source Heat Pump Specification published by NEEP
 - have a variable speed compressor
 - be part of an AHRI matched system
 - **have a coefficient of performance greater than or equal to 1.9 at 5 degree Fahrenheit and greater than or equal to 2.5 at 17 degree Fahrenheit**
- **For new construction, small air source heat pumps must supply 100% of a building's total annual heating and cannot have any supplemental, non-renewable heating sources**
- In retrofit construction or existing buildings, small air source heat pumps must
 - be used as the primary source of heat
 - **supply at least 90% of the total annual heating**
 - **be integrated to a heating distribution system**
 - Be capable of distributing produced heat to all conditioned areas of the building; and
 - have a heat-rate capacity at five degrees Fahrenheit that is at least 50% of the nameplate capacity of the existing heating source equipment
- **Large and intermediate air source heat pumps are not required to comply with any of the above requirements but more efficient systems will generate larger incentives based on metered thermal output**

Creating A Clean, Affordable, and Resilient Energy Future For the Commonwealth

What is the APS?
New Ren. Thermal Technologies
Program Logistics
Air Source Heat Pumps
<u>Ground Source Heat Pumps</u>
Solar Thermal
Biofuels
Biogas/ Compost Heat Exch.
Biomass
Fuel Cells
Waste to Energy
Qualification and Application
Examples
Links and Discussion

Ground Source Heat Pumps

- Can only receive Alternative Energy Certificates (AECs) when operating in heating mode
- Small ground source heat pumps must:
 - be certified to specific International Organization for Standards
 - meet specific AHRI rated operating coefficient of performance and operating energy efficiency ratios for their type of ground source heat pump
 - be installed by licensed contractors and/or plumbers in accordance with the National Electric Code and manufacturer's specifications
 - conform to all applicable municipal, state, and federal codes, standards, regulations, and certifications
 - have blowers that are multi-speed or variable-speed, high-efficiency motors
 - use compressors that are two-stage, multi-speed, or variable-speed drives, unless they are water-to-water units
 - comply with specific parameters regarding well depths and drilling
 - have at least 15 feet of separation between closed-loop bore holes
 - comply with all applicable MassDEP regulations
 - **supply 100% of a building's total annual heating**
- **Large and intermediate ground source heat pumps are not required to comply with any of the above requirements but more efficient systems will generate larger incentives based on metered thermal output**

What is the APS?
New Ren. Thermal Technologies
Program Logistics
Air Source Heat Pumps
Ground Source Heat Pumps
<u>Solar Thermal</u>
Biofuels
Biogas/ Compost Heat Exch.
Biomass
Fuel Cells
Waste to Energy
Qualification and Application
Examples
Links and Discussion

Solar Thermal

- Must be an active system
- Solar thermal collectors must have a performance certification to either OG-100 or OG-300. Rating certification entities may include:
 - Solar Rating and Certification Corporation
 - International Association of Plumbing and Mechanical Officials
 - Other certification entities as approved by DOER
- **Unglazed flat plate collectors for pool heating are not eligible to qualify as an APS Renewable Thermal Generation Unit**
- Solar hot air systems are eligible, if they meet the rating certification requirements

What is the APS?
New Ren. Thermal Technologies
Program Logistics
Air Source Heat Pumps
Ground Source Heat Pumps
Solar Thermal
<u>Biofuels</u>
Biogas/ Compost Heat Exch.
Biomass
Fuel Cells
Waste to Energy
Qualification and Application
Examples
Links and Discussion

Liquid Biofuels

- Eligible Liquid Biofuel **must be made from organic waste feedstocks** such as
 - waste vegetable oils
 - waste animal fats
 - grease trap waste
- Liquid Biofuel Generation Units may co-fire with other fuels, but must contain at least 10% by volume Eligible Liquid Biofuel**
- Fuel distributors will receive the AECs based on the quantity of Eligible Liquid Biofuel delivered to an end user for intermediate systems
- System owners will receive the AECs based on the quantity of Eligible Liquid Biofuel delivered to an end user for large systems**
- The number of AECs that can collectively be generated by liquid biofuel generators is capped at 20% of the total projected annual compliance obligation for retail suppliers

What is the APS?
New Ren. Thermal Technologies
Program Logistics
Air Source Heat Pumps
Ground Source Heat Pumps
Solar Thermal
<u>Biofuels</u>
Biogas/ Compost Heat Exch.
Biomass
Fuel Cells
Waste to Energy
Qualification and Application
Examples
Links and Discussion

Cap on the Available AECs for Biofuel Generation Units

- In each Compliance Year the total number of AECs minted to Generation Units using Eligible Liquid Biofuel may not exceed 20% of the total projected annual compliance obligation for the Compliance Year
 - No more than 10% of the Attributes generated prior to July 1st.
- If 100% of the Attributes available prior to July 1st are not allocated, the remaining number of available Attributes shall be rolled over and allocated during either of the remaining quarters in that calendar year
- If the number of Attributes reported by Generation Units exceeds the available Attributes, the number of available Attributes shall be allocated on a prorated basis

What is the APS?
New Ren. Thermal Technologies
Program Logistics
Air Source Heat Pumps
Ground Source Heat Pumps
Solar Thermal
<u>Biofuels</u>
Biogas/ Compost Heat Exch.
Biomass
Fuel Cells
Waste to Energy
Qualification and Application
Examples
Links and Discussion

Biofuels Suppliers List

- **DOER will establish and maintain a list of suppliers of Eligible Liquid Biofuel**
 - Fuel supplier must complete and submit an application to the DOER to be included on the list
 - Suppliers must be registered in the EPA’s Renewable Fuel Standard (RFS2) and must verify that they produce biodiesel from organic waste feedstocks
 - Fuel suppliers may be required to provide documentation to the DOER after being added to the list in order to demonstrate continued compliance
- Suppliers will provide information to DOER each quarter regarding the quantities of Eligible Liquid Biofuel delivered to customers

What is the APS?
New Ren. Thermal Technologies
Program Logistics
Air Source Heat Pumps
Ground Source Heat Pumps
Solar Thermal
Biofuels
<u>Biogas/ Compost Heat Exch.</u>
Biomass
Fuel Cells
Waste to Energy
Qualification and Application
Examples
Links and Discussion

Biogas and Compost Heat Exchange Systems

- Eligible Biogas Fuel is defined as follows in the Regulation:
 - A gaseous fuel that is produced by the contemporaneous bacterial decomposition or thermal gasification of Eligible Biomass Fuel. Eligible Biogas Fuel does not include natural gas but does include renewable natural gas, which is Eligible Biogas Fuel upgraded to a quality similar to natural gas
- A biogas Generation Unit must use Eligible Biogas Fuel derived from either an **anaerobic digester**, as defined by MassDEP, **or a landfill** that has received all applicable permits from the MassDEP or comparable environmental agency responsible for regulating such facilities
- **Eligible Biogas Fuel must be conveyed directly from its source to the biogas Generation Unit in a dedicated pipeline**

-
- A Compost Heat Exchange System is a Generation Unit that uses a facility to recover or exchange heat from the aerobic biodegradation of organic matter during the production of compost
 - Compost Heat Exchange Systems must have their thermal output directly metered

What is the APS?
New Ren. Thermal Technologies
Program Logistics
Air Source Heat Pumps
Ground Source Heat Pumps
Solar Thermal
Biofuels
Biogas/ Compost Heat Exch.
<u>Biomass</u>
Fuel Cells
Waste to Energy
Qualification and Application
Examples
Links and Discussion

Woody Biomass Requirements

- The statute requires DOER to set the following standards for biomass facilities:
 - in consultation with MassDEP, set **emission performance standards** that are protective of public health and limit eligibility only to best-in-class commercially-feasible technologies, with regard to reducing emissions of particulate matter sized 2.5 microns or less and carbon monoxide and other air pollutants;
 - establish a requirement of **50 percent reduction in life-cycle greenhouse gas emissions** compared to a high efficiency unit utilizing the fuel that is being displaced;
 - establish requirements for **thermal storage** or other means to minimize any significant deterioration of efficiency or emissions due to boiler cycling, if feasible;
 - establish fuel conversion **efficiency performance standards** achievable by best-in-class commercially-feasible technologies; and
 - in consultation with DCR, for forest-derived biomass, establish requirements that fuel shall be provided by means of **sustainable forestry practices**.

What is the APS?
New Ren. Thermal Technologies
Program Logistics
Air Source Heat Pumps
Ground Source Heat Pumps
Solar Thermal
Biofuels
Biogas/ Compost Heat Exch.
<u>Biomass</u>
Fuel Cells
Waste to Energy
Qualification and Application
Examples
Links and Discussion

Eligible Woody Biomass Feedstock

- 100% of the feedstock used by a Generation Unit must be Eligible Biomass Woody Fuels.
- Eligible Woody Biomass is divided into four categories:
 - Forest-Derived Residues (Residues)
 - Forest-Derived Thinnings (Thinnings)
 - Forest Salvage
 - Non-Forest-Derived Residues
- 30% of the feedstock used by a Generation Unit must come from a combination of the following:
 - Forest Derived Residues
 - Forest-Derived Thinnings
 - Forest Salvage, or
 - residues derived from wood products manufacturing consisting of Clean Wood

Emission Performance Standards

- DOER has worked closely with MassDEP to ensure that particulate matter emissions performance standards are protective of public health
- Standards are well below those currently required by the EPA for comparable systems and are differentiated by system size and fuel type:

A boiler or furnace of less than 3,000,000 Btu per hour rated heat input must meet applicable emissions limits below:		
	Pellets / Liquid Biofuels / Biogas	Chips
Particulate Matter emissions (PM)	$\leq 0.08 \text{ lb PM}_{2.5} \text{ per MMBtu}_{\text{input}}$ or $\leq 0.03 \text{ lb PM}_{2.5} \text{ per MMBtu}_{\text{input}}$ at sensitive populations	$\leq 0.10 \text{ lb PM}_{2.5} \text{ per MMBtu}_{\text{input}}$ or $\leq 0.05 \text{ lbs total PM per MMBtu}_{\text{input}}$ if EN303-5 is used to verify emissions or $\leq 0.03 \text{ lb PM}_{2.5} \text{ per MMBtu}_{\text{input}}$ at sensitive populations
Carbon monoxide (CO)	270 ppm at 7% oxygen	270 ppm at 7% oxygen
A boiler or furnace of greater than or equal to 3,000,000 Btu per hour rated heat input:		
PM, CO, and other relevant criteria pollutants	Commonwealth of Massachusetts Department of Environmental Protection (MassDEP) plan approval required, pursuant to 310 CMR 7.02(5).	

For the purpose of this provision, sensitive populations include schools, hospitals, nursing homes, or additional facilities determined by the Department.

What is the APS?
New Ren. Thermal Technologies
Program Logistics
Air Source Heat Pumps
Ground Source Heat Pumps
Solar Thermal
Biofuels
Biogas/ Compost Heat Exch.
<u>Biomass</u>
Fuel Cells
Waste to Energy
Qualification and Application
Examples
Links and Discussion

50% Reduction in Lifecycle GHG Analysis and Eligible Biomass Woody Fuel Supplier List

- Generation Unit owners will need to provide an annual analysis that shows, based on the type of woody biomass used, that there was a 50% reduction in greenhouse gases over a 30-year time period
- Analysis closely mirrors that used to demonstrate lifecycle GHG compliance under the RPS and relies closely on data from the Manomet Study
- The greenhouse gas analysis is based on the following inputs:
 - System efficiency
 - Annual thermal load
 - Fuel being displaced (Natural gas, fuel oil, electric resistance, etc)
 - Type of biomass fuel (Wood pellets, dry wood chips, green wood chips)
 - Biomass feedstock (Residues, thinnings)

**Massachusetts Department of Energy Resources
Alternative Energy Portfolio Standard - 225 CMR 16.00**

**Statement of Qualification Application (SQA)
Worksheet for the Calculation of Lifecycle GHG Analysis**

Generation Unit Name (as identified in SQA): **Typical Residential Biomass Pellet Boiler**

Please complete all blue cells

Life Cycle Greenhouse Gas Analysis

Biomass Lifecycle Stack Emissions from Generation Unit

Fuel Input	Wood Pellets	
	1 dry tons	
CO2 Emissions	16 MMBTU_input annually	
	218.3 lbs CO2/MMBTU_input	
	1.75 tons CO2 annually	

Conventional Lifecycle Stack Emissions Displaced

Thermal Boiler	Electric resistance	chose from drop-down list
	13.6 MMBTU_out	
	100% Boiler Efficiency (standard assumption)	
	Boiler Efficiency (optional user input)	
	13.60 MMBTU_in	
	212.8 lbs CO2/MMBTU	
	1.45 tons CO2 annually	
For Combined Heat and Power units <u>only</u> , enter the following		
Electric Generation	Natural Gas - Combined Cycle	If not NGCC, chose other from drop-down list
	0 MWh annually	
	1100 lbs CO2/MWh	
	0 tons CO2 annually	

Boiler Efficiency (justificaiton if not Standard Assumption):

Carbon Debt/Dividend Analysis

Carbon Debt	0.3 tons CO2 annually	
	17.1% carbon debt, %	
Biomass Supply Information		
Residues	65.0%	
Forest Derived Thinnings	55% % of supply	
	45% % of supply (calculated - Supply must sum to 100%)	
Net CO2 Emission Reductions		
Regulatory Requirement		
At least 50% reduction	55.8%	% reduction in Year 30

Note on Residues and Thinnings: Residues include Forest and Non-Forest Derived Residues, Forest Salvage, and Dedicated Energy Crops, as defined in 225 CMR 16.00.
<http://www.mass.gov/eea/docs/doer/rps/225cmr1600-052909.pdf>

Biomass Suppliers List

- Suppliers of Eligible Biomass Woody Fuel have the option to be placed on DOER’s list of eligible suppliers
- Depending on the characteristics of the fuel being displaced, there are different requirements on the composition of the woody biomass that must used by a biomass system:

Class	Fuel being displaced	Minimum combined percentage of Residues
Class I	Natural gas, electric resistance, propane, fuel oil #6, fuel oil #2	55%
Class II	Electric resistance, propane, fuel oil #6, fuel oil #2	50%
Class III	Fuel oil #6, fuel oil #2	35%

If a Generation Unit wishes to be exempt from the required GHG analysis they can simply purchase fuel from a supplier of biomass who DOER has preapproved as meeting the required GHG reductions

Biomass Thermal Storage Requirements

- A facility's thermal storage capacity should be sized based on the thresholds below:

Lead boiler system size (heat output)	Thermal storage required
< 80,000 Btu/hr	80 gallons
80,000 Btu/hr - 119,000 Btu/hr	1 gallon per 1,000 Btu/hr
119,000 Btu/hr – 1 MMBtu/hr	119 gallons
> 1 MMBtu/hr	2 gallons per 1,000 Btu/hr

- Any facility that wishes to omit thermal storage must submit independent test lab results based eligible testing methods that demonstrate the system is capable of the following:
 - Modulating below 20% of maximum building heat load
 - Maintaining emissions rates at the system's minimum tested capacity
 - Maintaining thermal efficiency at the system's minimum tested capacity
- Facilities may also submit requests for a thermal storage exception if they believe that the inclusion of thermal storage would deteriorate the efficiency or air emissions performance of the Generation Unit.

What is the
APS?

New Ren.
Thermal
Technologies

Program
Logistics

Air Source
Heat Pumps

Ground
Source
Heat Pumps

Solar
Thermal

Biofuels

Biogas/
Compost
Heat Exch.

Biomass

Fuel Cells

Waste to
Energy

Qualification
and
Application

Examples

Links and
Discussion

Biomass Fuel Conversion Efficiency Standards

- All facilities must comply with the following fuel efficiency standards, which ensure that only best in class commercially feasible technologies will be installed:

Performance Requirement	Pellets	Chips
Thermal efficiency at nominal output	≥ 85% Higher Heating Value	≥ 75% Higher Heating Value or ≥ 80% Lower Heating Value if EN303-5 is used to verify particulate emissions
Start up	Adhere to manufacturer’s ignition protocol	
Modulation/shut off	The system must automatically modulate to lower output and/or turn itself off when the heating load decreases or is satisfied	
Pressurized portion of the system	Compliant with 522 CMR 4.00	
Thermal storage	Required, unless an exception is issued by the Department	
Fuel storage	The system must have covered bulk storage	
Feedstock conveyance	The system must be automatically fed from feedstock storage to the furnace or boiler	

Biomass Fuel Quality Specifications

- A boiler or furnace of less than 3,000,000 Btu per hour rated heat input that utilizes an emission control device (e.g., electrostatic precipitator), does not have to meet the fuel quality specifications
- A boiler or furnace of less than 3,000,000 Btu per hour rated heat input that does not utilize an emission control device (e.g., electrostatic precipitator) must meet the following fuel quality specifications:

Fuel quality specifications	Pellets	Chips
Calorific value	Great than 8,000 Btu per pound	Greater than or equal to 5,500 Btu per pound
Moisture	Less than or equal to 8 percent	Less than or equal to 35 percent
Ash content by weight	Less than or equal to 1 percent	Less than or equal to 1.5 percent
Chip Size (percent retained by a half inch mesh screen)	Not applicable	75 percent or adhere to manufacturer's protocol
Chlorides	Less than or equal to 300 parts per million	Not applicable

- A boiler or furnace of equal to or greater than 3,000,000 Btu per hour rated heat input must receive a MassDEP plan approval pursuant to 310 CMR 7.02(5), which shall dictate fuel quality specifications

What is the APS?
New Ren. Thermal Technologies
Program Logistics
Air Source Heat Pumps
Ground Source Heat Pumps
Solar Thermal
Biofuels
Biogas/ Compost Heat Exch.
Biomass
Fuel Cells
Waste to Energy
Qualification and Application
Examples
Links and Discussion

Sustainable Forestry Practices

Sustainable Forestry Management is defined as:

Practicing a land stewardship ethic that integrates the reforestation, managing, growing, nurturing, and harvesting of trees for useful products with the conservation of soil, air and water quality, wildlife and fish habitat, and aesthetics and the stewardship and use of forests and forest lands in a way, and a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality, and potential to fulfill, now and in the future, relevant ecological, economic, and social functions at local, national, and global levels, and that does not cause damage to other ecosystems. Criteria for sustainable forestry include:

- *conservation of biological diversity;*
- *maintenance of productive capacity of forest ecosystems;*
- *maintenance of forest ecosystem health and vitality;*
- *conservation and maintenance of soil and water resources;*
- *maintenance of forest contributions to global carbon cycles;*
- *maintenance and enhancement of long-term multiple socioeconomic benefits to meet the needs of societies; and*
- *a legal, institutional, and economic framework for forest conservation and sustainable management.*

Creating A Clean, Affordable, and Resilient Energy Future For the Commonwealth

What is the APS?
New Ren. Thermal Technologies
Program Logistics
Air Source Heat Pumps
Ground Source Heat Pumps
Solar Thermal
Biofuels
Biogas/ Compost Heat Exch.
<u>Biomass</u>
Fuel Cells
Waste to Energy
Qualification and Application
Examples
Links and Discussion

Sustainable Forestry Practices

- All Forest Derived Residues and Thinnings must be sourced from sustainably managed forests. Sustainable Forest Managed must be verified as follows:
 - All MA forest derived products must have a DCR approved cutting plan under the long term management option, and signed by a state forester that attests to best management practices, and biomass harvesting and retention guidelines.
 - All non-MA forest derived products must either:
 - Have a **cutting plan that is approved by a licensed or certified forester** attesting that the harvest complied Sustainable Forestry Management definition, best management practices of the host state, and biomass harvesting and retention guidelines.
 - Biomass fuel is **certified to an independent third-party certification** that includes Forest Stewardship Council (FSC) and Program for the Endorsement of Forest Certification (PEFC), which includes the Sustainable Forestry Initiative (SFI) and American Tree Farm System (ATFS).
- DOER plans to implement an auditing program to ensure compliance.

What is the APS?
New Ren. Thermal Technologies
Program Logistics
Air Source Heat Pumps
Ground Source Heat Pumps
Solar Thermal
Biofuels
Biogas/ Compost Heat Exch.
Biomass
<u>Fuel Cells</u>
Waste to Energy
Qualification and Application
Examples
Links and Discussion

Fuel Cells

- A fuel cell is a device that uses hydrogen as a fuel in an electro-chemical reaction to produce electricity, thermal energy, and water.
- Hydrogen can be derived using a variety of fuels, but is most commonly done with natural gas
 - Fuel cells that use renewable fuel (e.g. biogas) can already qualify under the RPS
- In order to qualify, all fuel cells must demonstrate that they have a higher overall efficiency than the current average overall efficiency for emitting locational marginal units in ISO-NE
- **Fuel cells that generate both electricity and Useful Thermal Energy must have an overall efficiency of at least 55%**
- **Fuel cells will earn 1.5 AECs for each MWh of electricity or 3,412,000 BTUs of net Useful Thermal Energy they generate**
- Must be interconnected to the electric grid in MA

What is the APS?
New Ren. Thermal Technologies
Program Logistics
Air Source Heat Pumps
Ground Source Heat Pumps
Solar Thermal
Biofuels
Biogas/ Compost Heat Exch.
Biomass
Fuel Cells
<u>Waste to Energy</u>
Qualification and Application
Examples
Links and Discussion

Waste-to-Energy Thermal

- Waste-to-Energy Thermal Generation Units are defined as facilities that utilize conventional municipal solid waste plant technology to generate Useful Thermal Energy
- **Must have been in operation before January 1, 2016 in order to qualify**
- Only known facility that is expected to qualify is Covanta Energy's facility in Pittsfield, MA, which supplies steam to Crane Paper
- There are seven other electric Waste-to-Energy facilities that could qualify if they can find a nearby thermal load and convert their generators to CHP facilities

What is the APS?
New Ren. Thermal Technologies
Program Logistics
Air Source Heat Pumps
Ground Source Heat Pumps
Solar Thermal
Biofuels
Biogas/ Compost Heat Exch.
Biomass
Fuel Cells
Waste to Energy
<u>Qualification and Application</u>
Examples
Links and Discussion

Qualification Procedure

- Generation Unit submits a Statement of Qualification Application to DOER
- DOER reviews and approves the application
- The Independent Verifier (IV) begins recording and verifying production
 - MassCEC will be the IV for all small systems
- The Independent Verifier reports the production to the NEPOOL GIS
- The AECs are minted once a quarter
 - Small systems receive all their AECs in their first qualified minting

What is the APS?
New Ren. Thermal Technologies
Program Logistics
Air Source Heat Pumps
Ground Source Heat Pumps
Solar Thermal
Biofuels
Biogas/ Compost Heat Exch.
Biomass
Fuel Cells
Waste to Energy
<u>Qualification and Application</u>
Examples
Links and Discussion

APS Timeline

During project development:

- Be familiar with all APS requirements
- Consult DOER on metering if necessary
- Include all APS required documents as deliverables in bid packages

After installation:

- Contact an Independent Verifier (if necessary) and aggregator
- Submit Statement of Qualification Application (SQA)
- Begin metering and generating AECs

What is the APS?
New Ren. Thermal Technologies
Program Logistics
Air Source Heat Pumps
Ground Source Heat Pumps
Solar Thermal
Biofuels
Biogas/ Compost Heat Exch.
Biomass
Fuel Cells
Waste to Energy
<u>Qualification and Application</u>
Examples
Links and Discussion

Application Portal

- Went live on January 16th
- Hosted by the Massachusetts Clean Energy Center
- Portal and process is similar to the SREC II program
- The application is six steps, with the ability to save and exit after each step
- Includes in-portal communication function and automatic email updates

Renewable Thermal Application

Step 1

Step 2

Step 3

Step 4

Step 5

Step 6

System Information

System name REQUIREDA personalized name for your project

System Address

Street REQUIRED

Apartment or Suite

City REQUIRED ▾State REQUIRED ▾Zip REQUIREDEnter five digit zip code (12345) or five digit code with four digit extension (12345-6789)

About this Application

Systems may choose to size up their classification (Small to Intermediate or Large; Intermediate to Large) if they wish to implement additional metering technology. System owners should refer to the Department's Guideline on Metering for further information.

Please complete all required fields prior to moving to the next Step. Changes to this page will not be saved until the 'Save and Continue' option has moved the application to the next Step.

Contact Us

Tel	(617) 626-1180
Email	thermal.doer@state.ma.us

System Details

Electric Distribution Company REQUIRED ▾Gas Distribution Company REQUIRED ▾Facility Type REQUIRED ▾

What is the
APS?

New Ren.
Thermal
Technologies

Program
Logistics

Air Source
Heat Pumps

Ground
Source
Heat Pumps

Solar
Thermal

Biofuels

Biogas/
Compost
Heat Exch.

Biomass

Fuel Cells

Waste to
Energy

Qualification
and
Application

Examples

Links and
Discussion

Example - UMass Amherst Solar Thermal



Creating A Clean, Affordable, and Resilient Energy Future For the Commonwealth

DOER

Massachusetts Department
of Energy Resources

What is the APS?
New Ren. Thermal Technologies
Program Logistics
Air Source Heat Pumps
Ground Source Heat Pumps
Solar Thermal
Biofuels
Biogas/ Compost Heat Exch.
Biomass
Fuel Cells
Waste to Energy
Qualification and Application
<u>Examples</u>
Links and Discussion

Example - UMass Amherst Solar Thermal

- 60 Kingspan FPW-30 collectors
- Estimated Thermal Savings: 346,162 kBTU/yr
- Projected Cost Savings: ~\$5,000/yr
- APS incentive:
 - 346,162 kBTU = 101 MWH equivalence
 - Multiplier of 3
 - 303 annual AECs
 - Additional ~\$6,000/yr in AEC revenue (assuming \$20/AEC value)

What is the
APS?

New Ren.
Thermal
Technologies

Program
Logistics

Air Source
Heat Pumps

Ground
Source
Heat Pumps

Solar
Thermal

Biofuels

Biogas/
Compost
Heat Exch.

Biomass

Fuel Cells

Waste to
Energy

Qualification
and
Application

Examples

Links and
Discussion

Example – DFW Biomass Boiler



Creating A Clean, Affordable, and Resilient Energy Future For the Commonwealth

DOER

Massachusetts Department
of Energy Resources

What is the APS?
New Ren. Thermal Technologies
Program Logistics
Air Source Heat Pumps
Ground Source Heat Pumps
Solar Thermal
Biofuels
Biogas/ Compost Heat Exch.
Biomass
Fuel Cells
Waste to Energy
Qualification and Application
<u>Examples</u>
Links and Discussion

Example – DFW Biomass Boiler

- 191,000 btu/hr wood pellet boiler
- Estimated Thermal Savings: 851,560 kBTU/yr
- Projected Cost Savings: ~\$11,400/yr
- APS incentive:
 - 851,560 kBTU/yr = 250 MWH equivalence
 - Not eligible for a multiplier
 - 250 annual AECs
 - Additional ~\$5,000/yr in AEC revenue (assuming \$20/AEC value)

What is the APS?
New Ren. Thermal Technologies
Program Logistics
Air Source Heat Pumps
Ground Source Heat Pumps
Solar Thermal
Biofuels
Biogas/ Compost Heat Exch.
Biomass
Fuel Cells
Waste to Energy
Qualification and Application
Examples
Links and Discussion

Helpful Links

- [225 CMR 16.00 – Final Unofficial Version](#)
- [Guideline on Metering and Calculating the Useful Thermal Output for Renewable Thermal Generation Units – Part 1 \(Calculations for Small and Intermediate Generation Units\)](#)
- [Guideline on Metering and Calculating the Useful Thermal Output for Renewable Thermal Generation Units – Part 2 \(Metering for Intermediate and Large Generation Units\)](#)
- [Guideline on Biomass, Biogas, and Biofuels for Eligible Renewable Thermal Generation Units](#)
- [Guideline on Multipliers for Renewable Thermal Generation Units](#)
- [Guideline on Reduction of Greenhouse Gases for Eligible Renewable Thermal Generation Units Using Eligible Woody Biomass](#)
- [Guideline on Biomass Reporting Procedures](#)
- [Application Portal](#)

What is the APS?
New Ren. Thermal Technologies
Program Logistics
Air Source Heat Pumps
Ground Source Heat Pumps
Solar Thermal
Biofuels
Biogas/ Compost Heat Exch.
Biomass
Fuel Cells
Waste to Energy
Qualification and Application
Examples
Links and Discussion

Questions?

LBE Updates

Energy Resiliency Feasibility Study – Update

Evaluation of 12 state-owned 24/7 medical care facilities for opportunities to use clean energy technologies to increase the site's energy resiliency

Department of Veteran's Affairs	1. Holyoke Soldiers' Home
Department of Mental Health	2. Corrigan Mental Health Center
	3. Danvers Cottages (10, 2 & 3)
	4. Quincy Mental Health Center
	5. Harry C Solomon Mental Health Center
	6. Taunton State Hospital
Department of Developmental Services	7. Hogan Regional Center
	8. Wrentham Development Center
Department of Public Health	9. Tewksbury Hospital
	10. Western Massachusetts Hospital
Department of Youth Services	11. Stephen French Multiservice Center
	12. Northeast Regional Youth Services Center

- Arup has completed:
 - Task 1: energy resiliency gap assessment
 - Task 2: identification of clean energy technologies to increase energy resiliency of each site
- Next Steps:
 - Task 3: detailed cost & benefit analysis of 1-3 technologies per site
Examples: solar plus storage, combined heat and power, microgrids
 - Task 4: high level guidance document on energy resiliency
- Final report expected early April 2018

PowerOptions and Solar PPAs

- DOER, DCAMM & Power Options discussing a standard PPA to be approved for use by state entities
- Power Options close to selected winner for large solar PPA projects
- Solect is currently provider for small (<300 kW) solar PPA projects
- Current law permits public entities to utilize Power Options contracts without bidding process

Awarded Energy Grants

Recipient	Technology	Description	Amount Awarded
UMass Amherst	Feasibility Study (Alt. Fuels Analysis)	Grant for an alternative fuels analysis feasibility study of the expansion of Central Heating Plant and campus electrical distribution system at UMass Amherst. Includes the study of: <ul style="list-style-type: none"> • Alternative bio-fuel use in Central Heating Plant • Alternative fuels in existing, satellite and/or new buildings • Expansion of on-campus solar PV • Enhanced reliability and resiliency 	\$100,000
Dept. of Correction	Feasibility Study (Solar Canopy)	Grant for a solar canopy feasibility study of 67,000 sq. ft. parking area (three parking lots) at the Department of Correction's Milford Headquarters.	\$30,300
MA National Guard	Solar PV Canopy	Grant for 205kW solar canopy at Natick Readiness Center. Annually, expected to: <ul style="list-style-type: none"> • Generate 260,000 kWh • Save \$30,000 in energy costs • Produce enough to offset 82% of facility's electricity consumption Will include a dual-head EV charging station and pre-wiring for future additional stations.	\$256,250

mass.gov/service-details/leading-by-example-grants

Creating A Clean, Affordable and Resilient Energy Future For the Commonwealth



Massachusetts Department
of Energy Resources

Updated GHG Conversion Calculator

- Updated w/ FY17 Electricity GHG Conversion Factor

Calculator provides:

- Renewable energy conversions
- Energy efficiency conversions
- Building fuel calculations
- Vehicle fuel calculations

Renewable Energy Calculations			Equivalencies		
Renewable Capacity					
RE Source	Enter corresponding: Capacity (MW)	Predicted Generation (kWh)	MA Homes powered by Electricity (kWh)	MA Homes total energy use	kBtu Conversion Factor
Solar installed (MW)	1	1,157,196	152.26	30.61	3.412

Building Fuel Calculations			GHG Emissions*				
Select Year (CY or FY)	Fuel	Enter Fuel Amount (Native units)	GHG Emissions Factor (lbs CO2e/unit)	GHG Emissions Factor (metric tonnes CO2e/unit)	Total GHG Emissions (lbs)	Total GHG Emissions (metric tonnes)	MA Homes powered by Electricity (kWh)
FY_2017	Grid Electricity (kWh)	500,000.00	0.735	0.000334	367,709.50000	167.00000	65.79

Posted on LBE Website (Tools: Tracking and Guidance)

mass.gov/service-details/leading-by-example-tools-guidance-and-tracking

Creating A Clean, Affordable and Resilient Energy Future For the Commonwealth



Massachusetts Department
of Energy Resources

LBE Tracking Form

- Thank you to everyone who has submitted their FY17 Tracking Form!
- The data and information you provide annually is essential to the LBE Program

If you haven't already submitted your form or have questions – please contact Chelsea Kehne: chelsea.kehne@state.ma.us

Trial Court
Mass. Water Resources Authority
Bristol Community College
Bunker Hill Community College
Massasoit Community College
North Shore Community College
Quinsigamond Community College
Roxbury Community College
Springfield Tech. Community College
Bridgewater State University
Fitchburg State University
Framingham State University
Mass. College of Liberal Arts
Mass. Maritime Academy
Salem State University
Worcester State University
UMass Amherst
UMass Medical School
UMass Boston
UMass Lowell
UMass Dartmouth

LBE Award Recipients

State

- Dept. of Fish and Game: *ZNEB, land, pollinators*
- MassDOT-Highway: *solar, EVSE, sustainable landscaping*

Higher Education

- Roxbury CC: *'tri-level' energy project, EPPs*
- MA College of Liberal Arts: *GHG reductions, onsite CHP*

Municipal

- Town of Lexington & Sustainable Lexington: *residential energy efficiency program, solar*
- Town of Sterling & Sterling Municipal Light Dept.: *energy storage, municipal energy reductions*

Individual

- (Municipal): Kate Crosby, Acton-Boxborough Regional School District: *energy reductions, national and local outreach*
- (State): Alex Giannantonio, Cheryl Cushman, Karen Rasnick: Office of Vehicle Management team: *Fuel Efficiency Standard, collaboration/outreach*

State Recipients w/ State Officials:



Dept. of Fish and Game



MassDOT-Highway



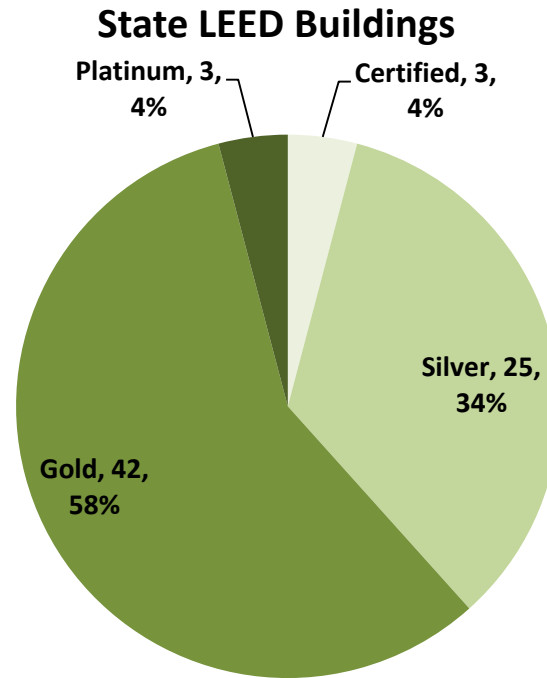
MCLA

Roxbury CC



OVM Team

State LEED Buildings Update



- *73 Certified Buildings, 14 in 2017*
- *Now more than 10 million SF certified*
- ***Does your LEED Certified or most energy-efficient building have a public area sign that highlights the building's energy features?***
 - *LBE developing sign template for custom use by agencies/campuses*
 - *Contact: Trey Gowdy: trey.gowdy@state.ma.us or 617-626-7328*

Clean Heating and Cooling Screening

LBE and UMass Clean Energy Extension:

- State Facility Clean Heating & Cooling Screening - Intake Form
 - Small-to-medium sized facilities
- Preliminary suitability evaluation for renewable thermal options
- *Process in development*
- *More to come next meeting*

Draft Form:

Massachusetts State Facility Clean Heating & Cooling Screening - Intake Form

Introduction

DOER's Leading By Example (LBE) and UMass Clean Energy Extension (CEE) are working in partnership to identify Clean Heating & Cooling (CH&C) project opportunities in selected small-to-medium sized state facilities. CH&C technologies include modern wood heat (e.g., pellet boilers), air-source heat pumps, ground-source heat pumps, and solar thermal systems. Information provided in this form will assist our team in conducting a preliminary suitability evaluation of these technologies for each identified facility based on information such as current building uses, heating fuel consumption, location, and general space conditions. This process will enable the research team to identify and prioritize facilities that may benefit from a deeper study related to CH&C technologies.

Instructions

1. Please complete the blue **Agency Contact Information** fields below.
2. Please complete the information in the separate **Facility Information Request** tab below.
3. Email completed spreadsheet file to Chris Beebe, CEE Research Fellow at ckbeebe@umass.edu.

Agency Contact Information

Please specify the contact person completing this information request. This person will serve as the primary contact for the LBE-CEE research team.

Agency Name:

Contact Name:

Contact Title:

Contact Email Address:

Contact Phone Number:

Clean Energy Extension - Contact Information

CEE is grateful for this opportunity to serve the Commonwealth and its state facilities. Our goal is be available and responsive to questions, feedback, comments, or concerns.

Facility Information Request – Instructions

1. Facilities may include one or more buildings.
2. For each building within a facility that uses a separate heating and/or cooling system, please enter the **facility name (column B)**, the **building name (column C)**, and **other requested information (columns D – Q)**.
3. Use a new (blank) row for each building within a given facility.
4. When complete, **save the spreadsheet file and email to Chris Beebe, CEE Research Fellow, at ckbeebe@umass.edu**.
5. Questions or assistance: **Chris Beebe, ckbeebe@umass.edu, 413.545.8510**.

Facility Information Request

[illegible]